

Children's Understanding of Time in Picture Books

Undergraduate Honors Research thesis

Presented in partial fulfillment of the requirements for graduation with *Honors Research Distinction* in Psychology in the undergraduate colleges of The Ohio State University

by
Taylor Wong

The Ohio State University
March 2015

Project Advisor: Laura Wagner, Department of Psychology

Abstract

Picture books are important for early literacy and convey information using both pictures and text. This study examines children's understanding of pictorial and textual means for sequencing events in picture books, focusing specifically on ongoingness and boundedness. Ongoingness is signaled in text with imperfective aspect (English Verb+ING, *was climbing*) and pictorially through Moment-to-Moment picture transitions, in which a picture sequence shows stages of one event and little time passes. Boundedness is signaled in text with perfective aspect (English Verb+ED, *climbed*) and pictorially through Action-to-Action transitions in which pictures shift from one event to succeeding events. In this study, children (N=51; mean age=5.8 years) were read four stories modified to show a particular combination of text (imperfective or perfective aspect) and picture (Moment-to-Moment or Action-to-Action transitions) temporal markers. After reading each story participants selected "what would happen next" from four choices: continuation of current event, closure of current event, reasonable next event, or completely unrelated action. Participants also retold the stories and judged the duration of story events. Control tasks assessed knowledge of imperfective and perfective aspect and ability to order pictures in Moment-to-Moment and Action-to-Action sequences. Preliminary analyses revealed that female participants' duration judgments were significantly shorter for stories with Moment-to-Moment picture transitions ($F(1, 23) = 8.68, p = .007$), suggesting that Moment-to-Moment stories were interpreted as reflecting fewer events. Although females' results were consistent with expected interpretations, the effects of pictures and text on males' duration judgments were non-significant. Further, males' responses to "what would happen next" were more often completely unrelated to story events (21.9% of responses) than females' (5.6% of responses). These results suggest that males at this age may have more difficulty than females

using pictures and language to sensibly interpret narrative. Future analyses will consider children's story retellings as well as results from adult participants to further deconstruct evident gender differences. These patterns in narrative comprehension will contribute to a greater understanding of children's language development and of the apparent gender differences at preschool age.

Narrative picture book reading during early childhood is associated with language growth, enhanced literacy, and reading achievement later in life. In an intervention study by Whitehurst et al. (1994), low-income children who were read to by day-care teachers and parents showed significant improvements on measures of expressive vocabulary. Previous research also suggests that picture book reading accounts for about 8% of the variance in literacy outcome measures (Bus, van IJzendoorn, & Pellegrini, 1995). In addition, the effects of early picture book reading are consistent across socioeconomic backgrounds, and are not dependent on methodological differences between particular studies. Despite the many positive outcomes associated with reading picture books, few studies have examined the connections between specific temporal markers and how they affect children's narrative comprehension. Further research regarding children's comprehension of temporal story events, or the concept of time in picture books, will contribute to a greater understanding of children's typical and atypical language development.

Children's Narrative Development

Previous research investigating children's understanding of time suggests that children younger than 3 years old have difficulty creating and understanding temporal connections between sequenced events (McColgan & McCormack, 2008). When young children are presented with a narrative, they may lack understanding of the overall story (Berman & Slobin, 1994). Instead, young children prefer to focus on people, objects, and actions in temporal isolation. Between 3 and 5 years of age, however, changes in children's ability to think about points in time reflect a shift from local to global organization of narrative information (McCormack & Hoerl, 2008; Thompson, Gomez, & Schvaneveldt, 2000; Winskel, 2007). In

other words, older children rely less on immediate contextual clues to draw conclusions about relations between events. For example, in a study by Winskel (2007), 4-year-olds produced narratives that primarily contained connectives such as “then,” “when,” and “before;” while 9-year-olds and adults used more complex temporal adverbials such as “meanwhile” and “in the meantime,” which relate events at a more global discourse level. Global organization of narrative information in older children suggests development of the ability to conceptualize single states and actions as individual parts of an overall event. This shift in organization of narrative information around age 5 is also consistent with the emerging ability to form more adult-like narratives at this age.

Evidence also exists for gender-related differences in preschool-aged children's narrative styles (Nicolopoulou & Richner, 2004). During storytelling and story-acting practice, boys more often than girls portray relatively disconnected characters in stories that lack a fundamental narrative framework. Boys' stories also achieve less coherence and continuity than girls' stories. These gender differences may be attributable to the types of picture books preschool-aged children read: while girls show more interest in fictional narrative stories, boys prefer to read nonfiction (Mohr, 2006). Further documenting the existence of gender differences in language abilities, Herlitz et al. (2013) found that girls between 12 and 14 years of age performed significantly better than boys on measures of verbal episodic memory and verbal fluency.

Core Temporal Event-Related Concepts: Ongoingness and Boundedness

Although young children may comprehend tense/aspect morphology, they tend to produce only a subset of the temporal-aspectual combinations available to them (Wagner, 2012). These temporal-aspectual groupings can be classified as either demonstrating ongoingness or

boundedness, and are presented in the vertical columns of Table 1. The horizontal rows display specific linguistic elements that convey temporal information: lexical aspect (known as aktionsart), grammatical aspect, and tense. Lexical aspect refers to inherent properties of a predicate, which can be either durative (atelic) or punctual (telic). Grammatical aspect, in contrast, refers to the imperfective/perfective distinction. Lastly, tense relates the time of an event to a designated reference point, usually the time of utterance. Until around two and a half years of age, children speaking a variety of languages generally produce durative verbs with present and imperfective morphology, and produce punctual verbs with past and perfective morphology. Previous research also indicates that sentences following these prototypical groupings are processed more quickly (Yap et al., 2009) than sentences containing a combination of both ongoing and bounded elements.

Table 1
Prototypical temporal/aspectual combinations demonstrated by young children

	Ongoing	Bounded
Lexical Aspect	Durative (atelic)	Punctual (telic)
Grammatical Aspect	Imperfective	Perfective
Tense	Present	Past

Temporal information in picture books is textually expressed through these two core temporal-aspectual combinations. However, picture books are unique in that they convey information through both text and pictures, and thus the concepts of ongoingness and boundedness are expressed not only through text but also through picture transitions. Sipe & Brightman (2009) found that children made important temporal inferences in narrative based on

picture transitions, including inferences about character actions, changes in setting, and elapsed time.

Although previous research indicates that picture transitions contribute to narrative understanding, few studies have investigated how the relationship between pictures and text contributes to this understanding. Sipe (2012) summarizes the four main functions of pictures in relation to text: congruency, augmentation, contradiction, and deviation. Congruency in a picture-text relationship indicates that pictures confirm the text, thus contributing to overall narrative construction and comprehension. Similarly, augmentation applies to picture-text relationships in which pictures complete the story expressed in text, and vice versa. Contradiction and deviation, on the other hand, describe picture-text relationships in which pictures and text communicate conflicting information or diverge from one another. Contradiction and deviation picture-text relationships may create puzzling scenarios that require readers to use their imagination in order to create a coherent narrative. Therefore we predict that children, in the same way that they prefer to use particular tense/aspect groupings expressing either ongoingness or boundedness, will also prefer picture and text groupings in picture books that congruently express either ongoingness or boundedness.

Ongoingness in Picture Books. Pictorially, ongoingness is conveyed in narrative picture books through Moment-to-Moment picture transitions (McCloud, 1993). In Moment-to-Moment picture transitions, very little time passes and there are few changes from one scene to the next. The reader may easily make sense of the transition between images. In the following panels from Marjane Satrapi's graphic novel *Persepolis* (Figure 1), there are very few differences between the scenes in the first and second panels, and the reader assumes that only seconds have passed.



Figure 1. An example of a Moment-to-Moment picture transition.

In the English language, ongoingness is textually conveyed in picture books through grammatical aspect, particularly the past/imperfective verb form. Consider the following example:

- (1) *Mary was climbing to the top of the mountain.*

In this sentence, *was climbing* is in the past/imperfective form, which consists of a bound morpheme (-ING) added to the verb in combination with the past auxiliary form (was/were). The auxiliary conveys tense information, and the progressive -ING ending is an imperfective marker. The past/imperfective form signals that the speaker is taking an open perspective on the event, and that the event was ongoing.

Boundedness in Picture Books. Pictorially, boundedness in narrative picture books is conveyed through Action-to-Action picture transitions. These transitions display a single subject in a progression of distinct events. In the following example (Figure 2), the character progresses from walking down the hallway, to knocking on the door, to opening the door. The reader assumes that some amount of time has elapsed in between each panel.



Figure 2. An example of an Action-to-Action picture transition.

Textually, boundedness is conveyed in narrative picture books through the use of the past/perfective grammatical aspect. Consider the following example:

(2) *Mary climbed to the top of the mountain.*

In this sentence, *climbed* is in the past/perfective form, which consists of a bound morpheme (-ED) added to the verb. The past/perfective form signals that the described event happened in the past, before the time of utterance. As a perfective aspect form, the past/perfective also signals a closed perspective on the event, and that the event is now completed.

Children's Understanding of Ongoingness and Boundedness in Picture Books

Previous research indicates that young children can distinguish between picture/text depictions of ongoingness and boundedness. Using a sentence-picture matching task in which pictures of complete/incomplete events were matched up with perfective/imperfective verbs, Weist (1983) found that by two and a half years of age Polish children can process tense/aspect contrasts. Similarly, Wagner, Swensen, & Naigles (2009) used a preferential looking comprehension task to determine when children initially become productive with tense and

aspect morphology. They found that by two and a half years of age, children correctly matched the past/perfective form of novel verbs to completed versions of the events, and matched the present/imperfective form of novel verbs to ongoing versions of the same events. When taken together, these results suggest that children may comprehend tense/aspect morphology by as early as about two and a half years of age.

Although previous research suggests that children can distinguish between ongoing and bounded pictures and text, few studies have examined how children use ongoing and bounded temporal markers to understand narrative. Instead, previous research has focused on adults, and suggests that the distinction between ongoingness and boundedness has important implications for adults' understanding of narrative. For example, adults' mental representations of narrative are influenced by verb tense and aspect while reading. Madden & Zwaan (2003) found that in a sentence-picture matching task, participants were faster to respond to completed pictures than ongoing pictures when primed with perfective sentences, but showed no differences after being primed with imperfective sentences. These results suggest that although readers construct mental representations of completed events when the perfective aspect is used, each reader may represent in-progress events at varying stages of completion. Verb tense and aspect also influence foregrounding and backgrounding of information by specifying what readers should focus on while constructing a mental event representation (Carreiras et al., 1997; Magliano & Schleich, 2000). In this way, these elements affect the accessibility of information during early stages of narrative processing. Carreiras et al. (1997) found that online accessibility of character's attributes in an event representation was faster for current attributes than for past attributes, and that characters in an event representation were more accessible when described using the past/progressive aspect than when described with the past/perfective aspect. Supporting

these results, Magliano & Schleich (2000) further discovered that after reading short sentences containing either perfective or imperfective activities, the activation level of perfective activities quickly decays below the threshold of activation necessary for accessibility in working memory. However, because imperfective activities are ongoing in mental event representations, they have the potential to remain relatively highly activated. Although this research indicates that adults create mental representations of narrative while reading and can apply these representations to pictorial depictions of the words, picture books provide a unique opportunity to examine younger readers' interpretations of narrative when pictures and text information align in an unexpected way.

Overview of the Present Study

While previous studies identify many different ways in which temporal events are understood, few studies have thoroughly examined the connections between specific temporal markers and children's narrative comprehension. The present study aims to determine how pictures and text interact to express the concepts of ongoingness and boundedness. In addition, the present study examines how well children understand these common pictorial and textual representations of temporal sequencing, and to what extent the integration of pictures and text help children with temporal understanding of narrative. Specifically, we use a picture book reading task and post-reading interview to examine the contributions of Moment-to-Moment/Action-to-Action picture sequences, as well as of imperfective/perfective grammatical aspect (ING/ED) on children's narrative comprehension. Because of the effects of age and gender on children's narrative ability documented by previous research (McColgan & McCormack, 2008; Berman & Slobin, 1994; Nicolopoulou & Richner, 2004), we will also

examine these factors in relation to temporal sequencing in picture books. In accordance with Carreiras et al. (1997) and Magliano & Schleich (2000), we predict that children will judge picture books with ongoing elements (Moment-to-Moment picture transitions and imperfective aspect) as having shorter duration and will recall more events from these stories than for picture books with bounded elements (Action-to-Action picture transitions and perfective aspect). In addition, we predict that picture books containing the prototypical tense/aspect groupings will be better understood and will lead to more consistent response patterns than picture books containing a combination of both ongoing and bounded picture/text elements.

Methods

Participants

Both children and adults were tested. The child group consisted of 51 children, with a mean age of 5.8 years (ranging from 3.6 to 8.3), and included 24 males and 27 females. An additional child was run but data was excluded from analyses because the participant failed to provide responses on most measures. Children were recruited at the Center for Science and Industry (COSI, a science museum in Columbus, Ohio) and run in the Language Sciences Research Lab. According to parental report, all children had English as their primary (and in most cases, only) language and were typically developing. The adult group was similarly recruited from COSI and consisted of 25 participants who were unrelated to participants in the child group. All adults reported being native speakers of English. Although adults were run in this study, only the child participant data was analyzed for the purposes of this honors thesis.

Procedures and Materials

Children were brought into the Language Sciences Research Lab and the experimenter randomized the participant into one of four experimental conditions. The session began with a brief discussion of basic time concepts. After establishing that the participant could distinguish between events that are shorter (for example, clapping your hands) and longer (for example, watching a movie) than “washing your hands,” the experimenter then read four short picture stories out loud to the participant.

The four short picture stories were titled *Annie*, *Ella the Elephant*, *JUMP!* and *Kitten for a Day*. The short stories were constructed by reorganizing the pictures and text of pre-existing picture books using The GNU Image Manipulation Program (GIMP). The original picture books used included *Ricky and Annie* (Genechten, 2010), *Ella the Elegant Elephant* (D’Amico & D’Amico, 2004), *Jump!* (Fischer, 2010), and *Kitten for a Day* (Keats, 2002). Full authorship information for the original picture books used to create stimuli can be found in the reference section. Stories were manipulated to include one of two different types of pictorial temporal transitions: Moment-to-Moment transitions or Action-to-Action transitions; as well as one of two different types of textual temporal elements: past/imperfective (ING) verbs or past/perfective (ED) verbs. Each participant read all four stories with the same picture/text combination (Figure 3). Pictures and text were displayed on each page of the picture story, and the pages were presented as a book so that two pictures appeared on facing pages. Each story consisted of 6 total pages: 1) a title page without a picture, 2) an introductory picture that set up the story plot, and 3-6) four core pictures that varied between Moment-to-Moment and Action-to-Action picture conditions.









(1) Core Moment-to- Moment Picture Transitions				
(1)a Imperfective Aspect	Annie was hopping on the hopscotch board.	Annie was hopping.	Annie was hopping.	Annie was hopping.
(1)b Perfective Aspect	Annie hopped on the hopscotch board.	Annie hopped.	Annie hopped.	Annie hopped.
(2) Core Action-to- Action Picture Transitions				
(2)a Imperfective Aspect	Annie was juggling three colorful balls.	Annie was jumping rope.	Annie and her friend Ricky were telling jokes.	Annie was hopping on the hopscotch board.
(2)b Perfective Aspect	Annie juggled three colorful balls.	Annie jumped rope.	Annie and her friend Ricky told jokes.	Annie hopped on the hopscotch board.

Figure 3. The four core pictures in Annie. (1) depicts the four core pictures in the Moment-to-Moment picture condition, while (2) depicts the four core pictures in the Action-to-Action picture condition. (1)a and 1(b) show the possible accompanying text for the Moment-to-Moment picture sequence, while 2(a) and 2(b) show the possible accompanying text for the Action-to-Action picture sequence.

After reading each story, participants were prompted to choose which event out of four different choices would logically occur next in the narrative. The four Next Event choices were displayed at the end of each story both with pictures and text (Figure 4), and always included 1) continuation of the current event, 2) closure of the current event, 3) a reasonable next event, and

4) a completely unrelated event focusing on a new character. These four possible responses were interpreted as spanning a continuum ranging from completely inside of the current event (choice 1) to completely outside of the current event (choice 4). Responses for each story were recorded as a number (1-4) and participant's responses were averaged across their four stories. A smaller average Next Event score, therefore, indicates that the participant chose responses which stayed within, or were more related to, story events. Likewise, a larger average score indicates that the participant chose responses that were outside of, or less related to, story events.





	1) Continuation of Current Event:	2) Closure of Current Event:	3) Reasonable Next Event:	4) Completely Unrelated Event:
(1)				
(1)a	Annie was hopping.	Annie was reaching the end of the hopscotch board.	Annie was going on a walk with Ricky.	Ricky was eating a carrot.
(1)b	Annie hopped.	Annie reached the end of the hopscotch board.	Annie went on a walk with Ricky.	Ricky ate a carrot.

Figure 4. The four Next Event choices in *Annie*. (1) displays the four pictures that were presented in all conditions as possible next events; (1)a shows the accompanying text in the Imperfective (ING) language conditions; and (1)b shows the accompanying text in the Perfective (ED) language conditions.

After choosing what event would occur next in the story, participants retold the events of the story. Responses were tape recorded and transcribed after the session from the video tapes.

Participants also gave Duration judgments for each of the four stories by determining whether

events in the story were collectively 1) shorter than, 2) the same amount of time as, or 3) longer than “washing your hands.” Duration judgments for each story were recorded as a number (1-3) and participant's responses were averaged across the four stories. Thus a smaller average Duration score indicates that the participant thought that story events were relatively short; and a larger average Duration score indicates that the participant thought story events were relatively long.

After reading all four picture stories the experimenter administered a short grammatical aspect task using pictures from Wagner (2009) to assess participants' baseline understanding of imperfective and perfective aspect and to examine the effect of reading stories with particular combinations of pictures and text on this understanding. Stimuli consisted of pairs of pictures presented in a book so that the separate halves of each pair appeared on pages facing one another. While one picture in each pair displayed an agent performing an action, the other picture displayed the agent finished with the action. Each picture also represented a linguistic target. For example, in one pairing (Figure 5) the first picture showed an easel with a half-painted flower and a woman facing the easel with a paintbrush in her hand, and this picture represented the linguistic target “The woman *was painting* a flower” (imperfective aspect). The second picture in this pair showed both the easel with a complete flower and a woman standing beside the easel, and this picture represented the linguistic target “The woman *ainted* a flower” (perfective aspect). When completing the task, attention was first drawn to each picture in the pair. The experimenter repeated both the perfective and imperfective sentences and asked the participant to indicate which picture represented a particular linguistic target: “In one of these pictures, the woman *ainted* a flower, and in the other picture, she *was painting* a flower. Which picture shows the woman *ainted* a flower?” Participants were taught the task using practice pictures.

Child responses were obtained from review of the video-taped sessions and scores were reported for each participant as the percentage of correct responses given.



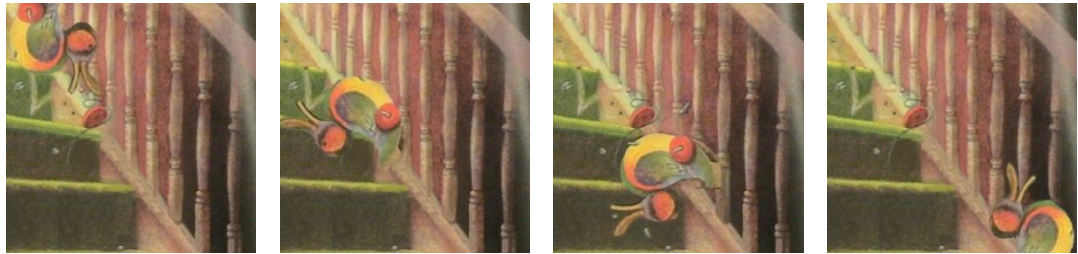
<p>Picture Shown:</p>		
<p>Linguistic Target Represented:</p>	<p>The woman was painting a flower (imperfective target).</p>	<p>The woman painted a flower (perfective target).</p>

Figure 5. Examples of picture stimuli from the grammatical aspect control task. Two pictures were presented at a time, each representing either an imperfective or perfective linguistic target.

A picture sequencing task was administered to assess participants' baseline understanding of narrative sequencing and to examine the effect of reading stories with particular combinations of pictures and text on this understanding. Pictures were obtained from Helen Cooper's pre-existing picture book titled *The Tale of Duck* and manipulated using GIMP to portray different types of picture sequences. When completing the task, participants were asked to arrange two sets of four pictures (Figure 6) in chronological order. One set of pictures displayed a Moment-to-Moment picture sequence, and one set displayed an Action-to-Action picture sequence. Scores were reported as either entirely correct or incorrect.

**(1)
Moment-
to-Moment
Picture
Sequence**



**(2) Action-
to-Action
Picture
Sequence**

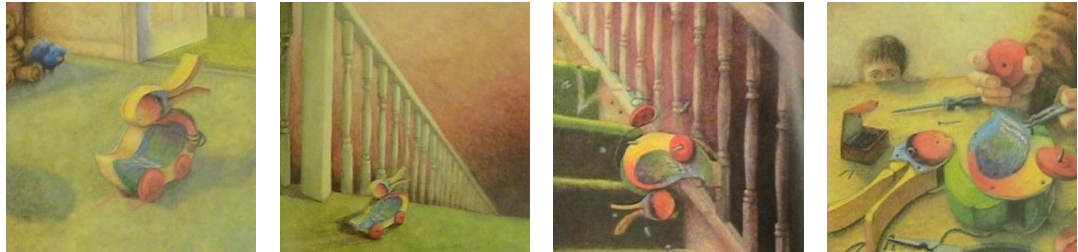


Figure 6. Stimuli used in the picture sequencing task. (1) Displays the Moment-to-Moment picture sequence, and (2) shows the Action-to-Action picture sequence. Participants were always shown the Action-to-Action pictures first, and then the Moment-to-Moment pictures. In both sequencing tasks, the four pictures were shown in a random order and participants were asked to arrange them chronologically.

Data Analysis

Analysis of variance (ANOVA) was used to compare the experimental groups' Next Event and Duration scores, as well as their scores on the Grammatical Aspect and Picture Sequencing tasks. Tables containing the complete report of ANOVA scores are found in the Appendix section. Pearson correlational analyses were also conducted to examine associations of these scores with one another and with age. Story retelling data was collected but not analyzed for the purposes of this honors thesis.

Results

The Duration, Next Event, Aspect Task, and Picture Sequencing Task scores were analyzed for differences between each picture/text condition. For each analysis the independent

variables were Pictures (Moment-to-Moment or Action-to-Action); Text (Imperfective or Perfective); and Gender (Male or Female).

Participant Characteristics

To see if age differed between the groups, a 2 (Pictures: Moment-to-Moment or Action-to-Action) x 2 (Text: Imperfective or Perfective) x 2 (Gender: Male or Female) ANOVA was conducted. Table 2 shows the mean age for participants in the different groups. The ANOVA revealed no significant differences in age across each condition and between genders. This analysis provides confidence that differences found across conditions is not due to differences among the participants within picture/text groups.

Table 2
Average Ages for each Picture/Text Condition

Pictures	Text	Gender	<i>N</i>	<i>M (SD)</i>
Moment-to-Moment	Imperfective (ING)	Male	6	5.82 (1.44)
		Female	8	5.77 (1.38)
	Perfective (ED)	Male	6	5.16 (1.38)
		Female	6	5.64 (1.49)
Action-to-Action	Imperfective (ING)	Male	6	6.33 (1.02)
		Female	8	5.83 (1.22)
	Perfective (ED)	Male	6	5.47 (1.28)
		Female	5	6.30 (1.22)

Next Event

Our first set of analyses examined the effect of pictures and text on children's decisions about what was likely to occur next in the stories. Possible responses included one of four choices: 1) continuation of the current event; 2) closure of the current event; 3) a reasonable next event; or 4) a completely unrelated event. Recall that this response was interpreted as spanning a continuum ranging from completely inside of the current event (choice 1) to completely outside of the current event (choice 4). Responses for each story were coded as a number (1 – 4) reflecting distance from the final picture in the story, and participants' responses were averaged across the four stories. Average Next Event scores (Table 3) were analyzed using a 2 (Pictures: Moment-to-Moment or Action-to-Action) x 2 (Text: Imperfective or Perfective) x 2 (Gender: Male or Female) ANOVA. Analyses (Table A-1 in the Appendix section) revealed no main effects or interactions between pictures or text. There was, however, a marginally significant main effect of Gender ($F(1, 43) = 3.74, p = .060$). Males ($M = 2.20, SD = 0.91$) tended to have higher average Next Event scores than females ($M = 1.78, SD = 0.50$). Thus males' responses to "what would happen next" were more often outside of the current story event compared to females, whose responses were more often related to current story events. Further, males' responses to "what would happen next" (Table 4) were more often completely unrelated to story events (21.9% of responses) than females' (5.6% of responses).

Table 3

Means and Standard Deviations of Next Event Judgments as a Function of Pictures, Text, and Gender

Pictures	Gender	Imperfective	Perfective
Moment-to-Moment	Male	2.29 (1.19)	2.38 (1.01)
	Female	1.84 (0.46)	1.83 (0.54)
Action-to-Action	Male	2.21 (0.51)	1.92 (1.00)
	Female	1.66 (0.55)	1.80 (0.54)

Note. Scores could range from 1-4.

Table 4

Percentage of Each Next Event Selected for Males and Females

Gender	Continuation of Current Event (1)	Closure of Current Event (2)	Reasonable Next Event (3)	Completely Unrelated Action (4)
Males	36.5%	29.2%	12.5%	21.9%
Females	44.4%	38.9%	11.1%	5.6%

Duration Judgments

Our second set of analyses examined the effect of pictures and text on how long children thought that story events took to occur. Stories were judged as either: 1) shorter than washing your hands; 2) the same amount of time as washing your hands; or 3) longer than washing your hands. Recall that duration judgments for each story were recorded as a number (1 - 3, respectively) and that participants' responses were averaged across the four stories. Thus average scores could range from 1 (shortest) to 3 (longest). Average duration scores (Table 5 and Figure

7) were analyzed using a 2 (Pictures: Moment-to-Moment or Action-to-Action) x 2 (Text: Imperfective or Perfective) x 2 (Gender: Male or Female) ANOVA. Results (Table A-2) revealed a significant interaction of Pictures and Gender ($F(1, 43) = 7.632, p = 0.008$). Within-Gender 2-factor ANOVAs (Pictures x Text) revealed a main effect of Pictures ($F(1, 23) = 8.684, p = 0.007$) only in the female group, with participants in the Moment-to-Moment picture conditions giving significantly shorter duration judgments ($M = 1.64, SD = 0.56$) than participants in the Action-to-Action conditions ($M = 2.18, SD = 0.53$). There was also a marginally significant effect of Text on duration judgments ($F(1, 23) = 4.148, p = 0.053$), with participants in the imperfective conditions giving shorter duration judgments ($M = 1.72, SD = 0.55$) than participants in the perfective conditions ($M = 2.09, SD = 0.58$). Thus in accordance with our hypotheses females gave shorter duration judgments for stories in the Moment-to-Moment and imperfective (ING) conditions; while males' duration judgments did not support our hypotheses and displayed no consistent patterns.

Table 5

Means and Standard Deviations of Duration Judgments as a function of Pictures, Text, and Gender

Pictures	Gender	Imperfective	Perfective
Moment-to-Moment	Male	2.21 (0.64)	2.25 (0.52)
	Female	1.44 (0.35)	1.83 (0.66)
Action-to-Action	Male	1.96 (0.46)	1.96 (0.64)
	Female	2.00 (0.42)	2.35 (0.42)

Note. Scores could range from 1-3.

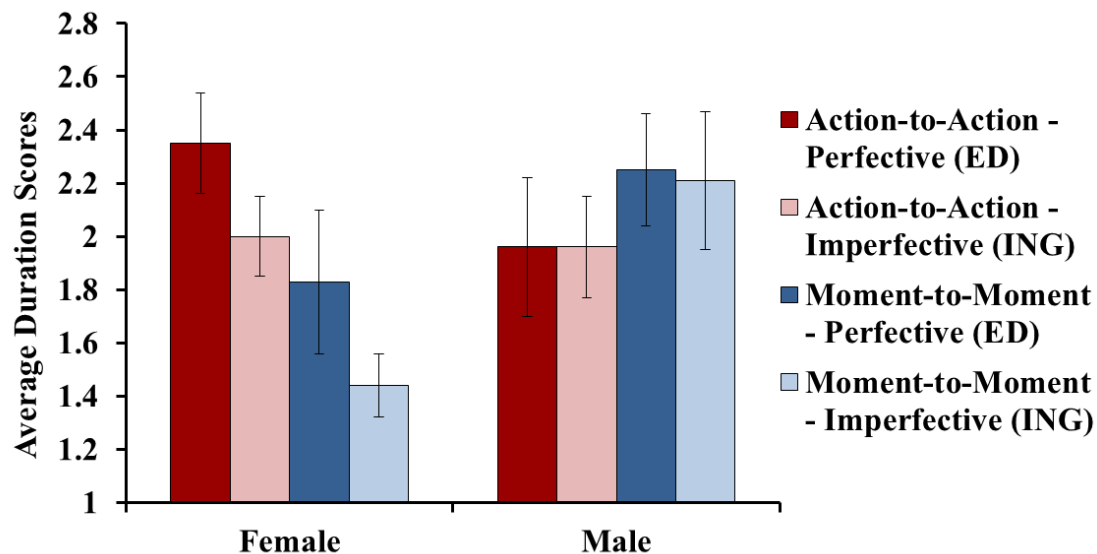


Figure 7. Consistent with our hypotheses, females' Duration judgments were shorter for stories with Moment-to-Moment picture transitions ($F(1, 23) = 8.68, p = .007$) and imperfective aspect ($F(1, 23) = 4.15, p = .053$). In other words, ongoing matches (stories with Moment-to-Moment pictures and imperfective text) led to the shortest duration judgments for female participants, while bounded matches (stories with Action-to-Action pictures and perfective text) led to the longest duration judgments.

Aspect Task

Scores on the imperfective and perfective Aspect Task items (Tables 6 and 7) were analyzed to assess participant's baseline understanding of imperfective and perfective aspect and to examine the effect of reading stories with particular combinations of pictures and text on these scores. Responses to imperfective and perfective items were coded for each participant as the percentage of correct responses given. Imperfective and perfective Aspect Task items were analyzed separately using 2 (Pictures: Moment-to-Moment or Action-to-Action) \times 2 (Text: Imperfective or Perfective) \times 2 (Gender: Male or Female) ANOVAs. Analyses (Tables A-3 and A-4) revealed no significant main effects of Pictures, Text, or Gender for scores on the imperfective items of the Aspect Task. However, for scores on the perfective items there was a significant interaction of Pictures, Text, and Gender. A within-Gender 2-factor ANOVA

(Pictures x Text) revealed a significant main effect of Text ($F(1, 23) = 5.148, p = 0.033$) and a marginally significant interaction of Pictures and Text ($F(1, 23) = 3.912, p = 0.060$) for the female group. Females' scores on the perfective items of the Aspect Task were significantly better after hearing stories that contained perfective (ED) text ($M = 63.64, SD = 34.21$), rather than imperfective (ING) text ($M = 40.63, SD = 24.93$). In particular, females' scores were higher on perfective items after hearing stories with both perfective (ED) text and Action-to-Action pictures ($M = 80.00, SD = 32.60$). In other words, females displayed language priming effects – their scores were higher for perfective items after hearing stories in the perfective aspect.

Table 6

Means and Standard Deviations of Aspect Task Scores on Imperfective Items as a Function of Pictures, Text, and Gender

Pictures	Gender	Imperfective	Perfective
Moment-to-Moment	Male	66.67 (20.41)	70.83 (36.80)
	Female	84.38 (18.60)	87.50 (20.92)
Action-to-Action	Male	100.00 (0.00)	75.00 (38.73)
	Female	81.25 (22.16)	95.00 (11.18)

Table 7

Means and Standard Deviations of Aspect Task Scores on Perfective Items as a Function of Pictures, Text, and Gender

Pictures	Gender	Imperfective	Perfective
Moment-to-Moment	Male	50.00 (15.81)	58.33 (25.82)
	Female	46.88 (20.86)	50.00 (31.62)
Action-to-Action	Male	75.00 (31.62)	50.00 (27.39)
	Female	34.38 (26.52)	80.00 (32.60)

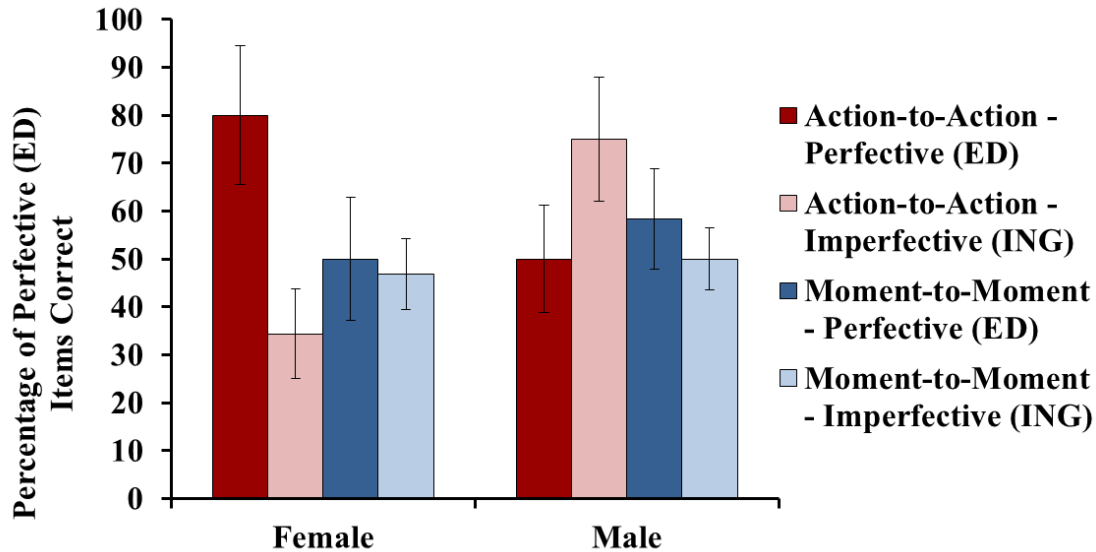


Figure 8. Females showed significantly better performance on the perfective items of the Aspect Task after hearing stories with perfective aspect ($F(1, 23) = 5.148, p = 0.033$). Further, females showed marginally significant better performance on these items after hearing stories with both Action-to-Action pictures and Perfective text ($F(1, 23) = 3.912, p = 0.060$).

Picture Sequencing Task

Scores on the Moment-to-Moment and Action-to-Action Picture Sequencing Tasks

(Tables 8 and 9) were analyzed to assess participant's baseline understanding of narrative sequencing and to examine the effect of reading stories with particular combinations of pictures and text on these scores. Participant's responses were reported as either entirely correct (1) or incorrect (0). Scores on the Moment-to-Moment and Action-to-Action Picture Sequencing Tasks were analyzed separately using 2 (Pictures: Moment-to-Moment or Action-to-Action) \times 2 (Text: Imperfective or Perfective) \times 2 (Gender: Male or Female) ANOVAs. Results (Tables A-5 and A-6) revealed no significant main effects of Pictures, Text, or Gender on Moment-to-Moment Picture Sequencing Task scores. On the Action-to-Action Picture Sequencing Task, there was a marginally significant main effect of Gender ($F(1, 43) = 3.725, p = 0.060$), with males having higher scores ($M = 0.50, SD = 0.51$) on this task than females ($M = 0.22, SD = 0.42$). Thus

regardless of Picture/Text condition, males were more often able to order pictures in Action-to-Action sequences than females.

Table 8

Proportion of Participants who Correctly Completed the Moment-to-Moment Picture Sequencing Task as a Function of Pictures, Text, and Gender

Pictures	Gender	Imperfective	Perfective
Moment-to-Moment	Male	0.33 (0.52)	0.33 (0.52)
	Female	0.38 (0.52)	0.17 (0.41)
Action-to-Action	Male	0.33 (0.52)	0.50 (0.55)
	Female	0.00 (0.00)	0.20 (0.45)

Table 9

Proportion of Participants who Correctly Completed the Action-to-Action Picture Sequencing Task as a Function of Pictures, Text, and Gender

Pictures	Gender	Imperfective	Perfective
Moment-to-Moment	Male	0.50 (0.55)	0.50 (0.55)
	Female	0.13 (0.35)	0.17 (0.41)
Action-to-Action	Male	0.67 (0.52)	0.33 (0.52)
	Female	0.25 (0.46)	0.40 (0.55)

Correlations

Pearson Correlational analyses (Table 10) were conducted to examine associations of Duration and Next Event scores, as well as scores on the Aspect and Picture Sequencing Tasks, with one another and with age. In accordance with previous research suggesting that children's understanding of aspect and narrative sequencing improves with age (McCormack & Hoerl, 2008; Thompson, Gomez, & Schvaneveldt, 2000; Winskel, 2007), we expected age to correlate

positively with scores on the Aspect and Picture Sequencing tasks. Results revealed a significant negative correlation between Age and Next Event scores, $r = -0.431$, $p = 0.002$, indicating that older participants were more likely to choose next events related to current story events and that younger participants more often chose next events that were less related to current story events. Scores on perfective items of the Aspect Task were significantly positively correlated with age, $r = 0.447$, $p = 0.001$, suggesting that older participants did better on this task than younger participants. Scores on the Moment-to-Moment and Action-to-Action Picture Sequencing Tasks were also significantly positively correlated with age, $r = 0.328$, $p = 0.019$; $r = 0.322$, $p = 0.021$. These results support our predictions and suggest that children's understanding of perfective/imperfective aspect and Moment-to-Moment/Action-to-Action picture sequences improves with age. Additionally, there was a significant positive correlation between scores on the Action-to-Action Picture Sequencing Task and the scores on the perfective items of the Aspect Task, $r = 0.371$, $p = 0.007$. There was also a significant positive correlation between scores on the Action-to-Action and Moment-to-Moment Picture Sequencing Tasks, $r = 0.281$, $p = 0.046$. Taken together, these correlational analyses appear to highlight task difficulty and how performance on these tasks improves (as we would expect) with age.

Table 10

Correlations between Age and Next Event, Duration, Aspect Task, and Picture Sequencing Task Scores

		Age	Next Event Scores	Duration Scores	Aspect Task (Imperfective)	Aspect Task (Perfective)	Picture Task (Moment- to- Moment)	Picture Task (Action- to- Action)
Age	<i>r</i>	1	-.431**	.112	.201	.447**	.328*	.322*
	<i>p</i>		.002	.435	.158	.001	.019	.021
Next Event Scores	<i>r</i>		1	.098	-.160	-.184	-.128	-.226
	<i>p</i>			.495	.262	.196	.369	.111
Duration Scores	<i>r</i>			1	-.084	.173	.113	.133
	<i>p</i>				.557	.224	.431	.354
Aspect Task (Imperfective)	<i>r</i>				1	.225	-.005	-.054
	<i>p</i>					.112	.971	.705
Aspect Task (Perfective)	<i>r</i>					1	.148	.371**
	<i>p</i>						.299	.007
Picture Task (Moment-to- Moment)	<i>r</i>						1	.281*
	<i>p</i>							.046
Picture Task (Action-to- Action)	<i>r</i>							1
	<i>p</i>							

Note. **Correlation is significant at the 0.01 level (2-tailed); *Correlation is significant at the 0.05 level (2-tailed)

Discussion

In this study, we examined the effects of different picture and text combinations on children's understanding of time in narrative picture books. Specifically, we studied two pictorial temporal markers: Moment-to-Moment and Action-to-Action picture transitions; as well as two textual temporal markers: imperfective and perfective verb aspect. After reading a story with either Moment-to-Moment or Action-to-Action pictures and either imperfective or perfective aspect, children determined what would most likely happen next in the story, retold the story, and judged how long story events took to occur. Children also completed an aspect task and a picture sequencing task to assess participants' understanding of verb aspect and narrative sequencing.

Next Event

Participants' judgments about what would happen next in each story were coded as Next Event scores (1 – 4) spanning a continuum ranging from completely inside of the current event (choice 1) to completely outside of the current event (choice 4), and participants' responses were averaged across the four stories. Males tended to have higher average Next Event scores than females. This indicates that their responses to “what would happen next” were more often outside of the current story events than females' responses. The higher average score for males likely occurred because males chose choice 4 (a completely unrelated event) for about one fifth of their total responses, which was much more frequently than females. The persistence of males choosing unrelated events as occurring next in the stories may reflect males' narrative abilities at this age. In the present study, males appear to display a pattern of narrative comprehension similar to that of younger children, who prefer to focus on people, objects, and actions in

temporal isolation instead of in terms of the overall story. This supports the findings of Nicolopoulou & Richner (2004), who found that boys express more disconnected characters and less narrative coherence than girls during storytelling practice. Another possible explanation for males' responses is that these participants paid less attention or were less interested in reading the stories. Previous research shows that boys prefer stories about boys and men (Bleakley, Westerberg, & Hopkins, 1988; Connor & Serbin, 1978). Although two of the stories used in the present study portrayed female main characters and two of the stories portrayed male main characters, the female characters were more obviously female (for example, they wore dresses) and the male characters appeared more as gender-neutral animals, with gender signified only through pronouns. Thus the greater presence of female characters in the stories may have contributed to males' disinterest.

Ongoing analyses of the present study focus on interpreting this gender difference, and are examining the participants' story retellings to inspect what children actually remember from the stories. If males who remember main story events still consistently chose unrelated events as occurring next, this would indicate that males do pay attention to the stories but are not integrating pictures and text in their narrative understanding in the same way as females.

Duration Judgments

This study also found gender differences in the amount of time that participants thought story events took to occur. In support of our hypotheses, females interpreted stories with Moment-to-Moment picture transitions and imperfective aspect as shorter than stories with Action-to-Action picture transitions and perfective aspect. In accordance with Carreiras et al. (1997) and Magliano & Schleich (2000), these results suggest that ongoing pictures and text may

remain more highly activated in mental representations of narrative than bounded pictures and text. Males, however, did not display this trend. Although not statistically significant, males judged stories with Moment-to-Moment picture transitions as longer than stories with Action-to-Action transitions. This pattern is actually the opposite of what we would expect, and contrasts with females' results. Further, this pattern suggests that textual temporal markers (imperfective and perfective aspect) had less effect on males' narrative understanding than pictorial temporal markers (Moment-to-Moment and Action-to-Action picture transitions) did.

The small duration scale used in the present study may have contributed to the observed inconsistent patterns between male and female duration judgments. Only three duration judgments were possible for each story: 1) shorter than washing your hands; 2) the same amount of time as washing your hands; or 3) longer than washing your hands. Thus duration judgments only ranged from 1 (shorter than washing your hands) to 3 (longer than washing your hands). Future studies should include a larger scale, which would allow participants to further differentiate between shorter and longer story events.

Aspect Task

Groups performed comparably well on the imperfective items of the Aspect Task, with no significant main effects of pictorial/textual temporal markers or gender on these scores. All groups had lower average scores on the perfective items of the aspect task. However, females' scores on the perfective items were significantly better after hearing stories that contained perfective text rather than imperfective text, and were highest after hearing stories that contained both perfective text and Action-to-Action pictures. Thus females displayed language priming effects – their scores on perfective items were higher after hearing stories with perfective aspect.

The score increase after hearing stories with Action-to-Action pictures further suggests that when stories display the prototypical boundedness grouping (Action-to-Action pictures and Perfective text), these priming effects are increasingly apparent.

On both the imperfective and perfective items of the Aspect Task, males' scores were highest after hearing stories with Action-to-Action pictures and imperfective text. Although this effect is non-significant, the trend towards increased performance in this condition may have occurred simply because this group (males in the Action-to-Action pictures/imperfective text story condition) had the highest average age in the study. Since correlational analyses indicated that performance on the perfective items of the aspect task was associated with age, it is not surprising that males in this group performed better on the Aspect Task than males in other conditions, although analyses determined that the age difference between groups was non-significant.

Picture Sequencing Task

Scores on the Picture Sequencing Tasks were largely unaffected by pictorial/textual temporal markers. Across different picture/text conditions and for both males and females, average scores on the Picture Sequencing Tasks were generally much lower than scores on the Aspect Task. Despite this discrepancy, scores on both Picture Sequencing Tasks were correlated positively with age. Thus lower scores on this task likely reflect the inherent difficulty of the task, rather than the effects of particular picture/text conditions on responses, especially for younger participants. On the Action-to-Action Picture Sequencing Task, however, males tended to perform better than females regardless of picture/text condition.

Although non-significant, the higher scores of males on the Action-to-Action Picture Sequencing Task appear counterintuitive in the context of the results of the larger study. However, this finding is consistent with previous research on gender differences in adult cognition suggesting that males often perform better on tasks of spatial ability, although this difference is dependent on specific experimental factors (Coluccia & Louse, 2004). Interestingly, the ability of males to sequence pictures at this age, coupled with the fact that pictures influenced males' duration judgments to a greater extent than text, indicates that males may use pictures more than text to interpret narrative information in picture books. Future studies should further explore gender differences in the relative contribution of pictures and text to children's narrative understanding. In addition, future research on children's narrative sequencing abilities should implement a picture sequencing task that is easier for children to complete at this age. An easier task would better estimate differences in scores resulting from picture/text conditions and gender, rather than differences that merely reflect participants' ages.

Limitations

The results of the present study were limited by several factors. Participants were recruited from a science museum, which may not be representative of the entire population. Previous research indicates that higher education and income is positively correlated with visits to science museums (Kirchberg, 1996), which may in turn bias this study sample towards including children with higher socioeconomic status. However, the intended purpose of this study was to examine the effects of pictures and text on children's narrative understanding. Although the sample used may not be representative of the entire population, the mechanisms

which affect these children's narrative understanding should remain consistent across children from various income households.

Additionally, results may have been limited by the ages of the sample population obtained. Although analyses revealed no significant age differences between groups and that duration judgments were not affected by age, previous research indicates that many changes in narrative ability occur between the ages of 3 and 5, particularly the shift from local to global organization of narrative (McCormack & Hoerl, 2008; Thompson, Gomez, & Schvaneveldt, 2000; Winskel, 2007). Children in our study ranged from 3.6 to 8.3 years of age, and thus may have been in different stages of narrative development at the time of the study. Future studies may benefit from organizing participants into distinct groups based on age to further examine the effects of age on narrative understanding.

Differences in the types of stories used in this study may have also influenced results. For example, four distinct actions were portrayed in stories with Action-to-Action picture transitions, while only one distinct action was portrayed in the stories with Moment-to-Moment picture transitions. This was done purposefully to keep the number of picture transitions constant between conditions, although it did create a fundamental difference between stories in the Moment-to-Moment and Action-to-Action picture conditions in the number of distinct events that were portrayed. If the number of events biased results, the bias would have been towards shorter duration judgments in stories with Moment-to-Moment picture transitions because they represent fewer events. Despite this potential bias, however, males tended to actually give longer duration judgments for these stories, which provides further evidence for the distinction between how males and females use pictures and text to interpret narrative at this age. Future studies in which the number of events, rather than the number of picture transitions, is maintained between

conditions would allow researchers to determine whether girls' shorter duration judgments found in this study were primarily due to the effects of Moment-to-Moment picture transitions, or whether they were due to fewer events occurring in the stories.

Conclusions

The results of this study provide evidence for gender differences in children's understanding of time in picture books. Males appeared to have more overall difficulty across the tasks of this study than females. Males more often chose last pictures that were unrelated to story events, and tended to attribute longer duration judgments to stories with Moment-to-Moment picture transitions, contrary to our hypotheses. Interestingly, males performed marginally better than females on the Action-to-Action picture sequencing task. These results suggest that boys may have more well developed visual-spatial knowledge at this age, and that they may use pictures more than text to interpret narrative information from picture books.

On the other hand, in accordance with our hypotheses females gave duration judgments that were shorter for both stories with Moment-to-Moment picture transitions and imperfective aspect. In addition, Females' scores on the perfective items of the Aspect Task increased after reading stories with perfective aspect and Action-to-Action pictures. Thus girls' understanding of narrative appears to be influenced by integration of pictures and text in predictable ways, and tends to be influenced along the core temporal-related concepts of ongoingness (Moment-to-Moment pictures and imperfective aspect) and boundedness (Action-to-Action pictures and perfective aspect).

The results of this study suggest that males and females at this age use ongoing and bounded temporal markers differently to interpret narrative stories. Males seem to be affected by

pictures more than text, while females integrate pictures and text to sensibly interpret narrative in ways consistent with previous literature. Future analyses will investigate the effects of these temporal markers and gender on children's memory for particular story events, which will be examined through participants' story retellings. In addition, the present results will be compared with adult participants' responses to determine if children display similar patterns in narrative comprehension to adults.

Despite the many positive outcomes associated with reading picture books, to our knowledge no existing studies have systematically investigated the influence of particular pictorial and textual temporal markers in picture books on children's narrative understanding. Further research regarding children's understanding of time in picture books will contribute to a greater understanding of children's language development and of the apparent gender differences at preschool age.

References

- Berman, R. A., & Slobin, D. I. (1994). Relating events in narrative: A crosslinguistic developmental study. Hillsdale, NJ: Lawrence Erlbaum Associates.
- Bleakley, M.E., Westerberg, V., & Hopkins, K.D. (1988). The effect of character sex on story interest and comprehension in children. *American Education Research Journal*, 25, 145-155.
- Bus, A. G., van IJzendoorn, M. H., & Pellegrini, A. D. (1995). Joint book reading makes for success in learning to read: A meta-analysis on intergenerational transmission of literacy. *Review of Educational Research*, 65, 1-21.

- Carreiras, M., Carriedo, N., Alonso, M. A., & Fernandez, A. (1997). The role of tense and verb aspect in the foregrounding of information during reading. *Memory and Cognition*, 25, 438-446.
- Coluccia, E., & Louse, G. (2004). Gender differences in spatial orientation: A review. *Journal of Environmental Psychology*, 24, 329-340.
- Connor, J. M., & Serbin, L. A. (1978). Children's responses to stories with male and female characters. *Sex roles*, 4, 637-645.
- Herlitz, A., Reuterskiöld, L., Loven, J., Thilers, P. P., & Rehnman, J. (2013). Cognitive sex differences are not magnified as a function of age, sex hormones, or puberty development during early adolescence. *Developmental Neuropsychology*, 38, 167-179.
- Kirchberg, V. (1996). Museum visitors and non-visitors in Germany: A representative survey. *Poetics*, 24, 239-258.
- Madden, C. J., & Zwaan, R. A. (2003). How does verb aspect constrain event representations? *Memory and Cognition*, 31, 663-672.
- Magliano, J. P., & Schleich, M. C. (2000). Verb aspect and situation models. *Discourse Processes*, 29, 83-112.
- McCloud, S. (1993). *Understanding Comics: The Invisible Art*. New York, NY: Harper Collins.
- McColgan, K. L., & McCormack, T. (2008). Searching and planning: Young children's reasoning about past and future event sequences. *Child Development*, 79, 1477-1497.
- McCormack, T., & Hoerl, C. (2008). Temporal decentering and the development of temporal concepts. *Language Learning*, 58, 89-113.

- Mohr, K. A. J. (2006). Children's choices for recreational reading: a three-part investigation of selection preferences, rationales, and processes. *Journal of Literacy Research*, 38, 81-104.
- Nicolopoulou, A., & Richner, E. S. (2004). 'When your powers combine, I am Captain Planet': The developmental significance of individual- and group-authored stories by preschoolers. *Discourse Studies*, 6, 347-371.
- Satrapa, M. (2004). *Persepolis*. New York, NY: Pantheon Books.
- Sipe, L. R. (2012). Revisiting the relationships between text and pictures. *Children's Literature in Education*, 43, 4-21. DOI: 10.1007/s10583-011-9153-0.
- Sipe, L. R., & Brightman, A. E. (2009). Young children's interpretations of page breaks in contemporary picture storybooks. *Journal of Literacy Research*, 41, 68-103. DOI:10.1080/10862960802695214.
- Thompson, L. A., Gomez, R. L., & Schvaneveldt, R. W. (2000). The salience of temporal cues in the developing structure of event knowledge. *The American Journal of Psychology*, 113, 591-619.
- Wagner, L. (2009). I'll never grow up: Continuity in aspect representations. *Linguistics*, 47, 1051-1074.
- Wagner, L. (2012). Primary Language Acquisition. In Binnick, R. (ed), *The Oxford Handbook of Tense and Aspect*. Oxford: Oxford University Press. 458-480.
- Wagner, L., Swensen, L. D., & Naigles, L. R. (2009). Children's early productivity with verbal morphology. *Cognitive Development*, 24, 223-239.

- Weist, R. M. (1983). Time concepts in language and thought: Filling the Piagetian void from two to five years. In I. Levin & D. Zakay (eds), *Time and Human Cognition: A Life-Span Perspective* (North-Holland: Elsevier Science Publishers).
- Whitehurst, G. J., Arnold, D. S., Epstein, J. N., Angell, A. L., Smith, M., & Fischel, J. E. (1994). A picture book reading intervention in day care and home for children from low-income families. *Developmental Psychology*, 30, 679-689.
- Winskel, H. (2007). The expression of temporal relations in Thai children's narratives. *First Language*, 27, 133-158.
- Yap, F. H., Chu, P. C. K., Yiu, E. S. M., Wong, S. F., Kwan, S. W. M., Matthews, S., Tan, L. H., Li, P., & Shirai, Y. (2009). Aspectual asymmetries in the mental representation of events: Role of lexical and grammatical aspect. *Memory and Cognition*, 37, 587-595.

Picture Books Used to Create Stimuli:

- Cooper, H. (1995). *Tale of duck*. New York, NY: Lothrop, Lee and Shepard Books.
- D'Amico, C. & D'Amico, S. (2004). *Ella the elegant elephant*. New York, NY: Scholastic US.
- Fischer, S. M. (2010). *Jump!* New York, NY: Simon & Schuster Children's.
- Genechten, G. V. (2010). *Ricky and Annie*. Chicago, IL: Clavis Publishing.
- Keats, E. J. (2002). *Kitten for a day*. Hawthorn, AU: Puffin.

Appendix

Table A-1

Three-way Analysis of Variance of Next Event Judgments by Pictures by Text by Gender

Source	<i>df</i>	<i>SS</i>	<i>MS</i>	<i>F</i>	<i>p</i>
Pictures	1	.453	.453	.790	.379
Text	1	.004	.004	.008	.931
Gender	1	2.143	2.143	3.738	.060
Pictures * Text	1	.038	.038	.066	.798
Pictures * Gender	1	.080	.080	.140	.710
Text * Gender	1	.091	.091	.159	.692
Pictures * Text * Gender	1	.218	.218	.381	.541

Table A-2

Three-Way Analysis of Variance of Duration Judgments by Pictures by Text by Gender

Source	<i>df</i>	<i>SS</i>	<i>MS</i>	<i>F</i>	<i>P</i>
Pictures	1	.225	.225	.839	.365
Text	1	.483	.483	1.802	.187
Gender	1	.443	.443	1.652	.206
Pictures * Text	1	.006	.006	.022	.882
Pictures * Gender	1	2.047	2.047	7.632	.008*
Text * Gender	1	.386	.386	1.441	.237
Pictures * Text * Gender	1	1.353E-5	1.353E-5	.000	.994

Table A-3

Three-way Analysis of Variance of Aspect Task Scores on Imperfective Items by Pictures by Text by Gender

Source	<i>Df</i>	<i>SS</i>	<i>MS</i>	<i>F</i>	<i>p</i>
Pictures	1	1366.376	1366.376	2.360	.132
Text	1	12.209	12.209	.021	.885
Gender	1	988.941	988.941	1.708	.198
Pictures * Text	1	267.891	267.891	.463	.500
Pictures * Gender	1	855.012	855.012	1.476	.231
Text * Gender	1	1107.988	1107.988	1.913	.174
Pictures * Text * Gender	1	1233.800	1233.800	2.131	.152

Table A-4

Three-way Analysis of Variance of Aspect Task Scores on Perfective Items by Pictures by Text by Gender

Source	<i>Df</i>	<i>SS</i>	<i>MS</i>	<i>F</i>	<i>p</i>
Pictures	1	909.632	909.632	1.280	.264
Text	1	802.083	802.083	1.129	.294
Gender	1	380.005	380.005	.535	.469
Pictures * Text	1	65.476	65.476	.092	.763
Pictures * Gender	1	.541	.541	.001	.978
Text * Gender	1	3334.551	3334.551	4.693	.036*
Pictures * Text * Gender	1	4481.061	4481.061	6.307	.016*

Table A-5

Three-way Analysis of Variance of Scores on the Moment-to-Moment Picture Sequencing Task by Pictures by Text by Gender

Source	<i>Df</i>	<i>SS</i>	<i>MS</i>	<i>F</i>	<i>p</i>
Pictures	1	.024	.024	.114	.737
Text	1	.020	.020	.093	.762
Gender	1	.448	.448	2.139	.151
Pictures * Text	1	.258	.258	1.230	.274
Pictures * Gender	1	.201	.201	.961	.332
Text * Gender	1	.024	.024	.114	.737
Pictures * Text * Gender	1	.046	.046	.217	.644

Table A-6

Three-way Analysis of Variance of Scores on the Action-to-Action Picture Sequencing Task by Pictures by Text by Gender

Source	<i>Df</i>	<i>SS</i>	<i>MS</i>	<i>F</i>	<i>p</i>
Pictures	1	.100	.100	.427	.517
Text	1	.016	.016	.067	.797
Gender	1	.873	.873	3.725	.060
Pictures * Text	1	.039	.039	.168	.684
Pictures * Gender	1	.100	.100	.427	.517
Text * Gender	1	.215	.215	.917	.344
Pictures * Text * Gender	1	.152	.152	.649	.425